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THE SMITHSONIAN INSTITUTION—PARENT OF AMERICAN SCIENCE[1]

YOU have been invited here to-day to discuss the future of an institution which was given to this country by a native and resident of another; an institution which enjoys the protection of the United States government and is yet a private organization; an institution which inspired the orderly development of American science and which, as long ago as 1850, made youthful American an international patron of thought and knowledge.

James Smithson was an Englishman. He was the natural son of the Duke of Northumberland and a direct descendant through his mother of Henry VII, King of England. Embittered by the bar sinister on his name, this gentleman of the eighteenth century was yet great-spirited enough to devote his life to the service of men. A chemist and mineralogist of repute, he was admitted to the Royal Society at the early age of twenty-two. "Every man," he said, "is a valuable member of society who, by his observations, researches and experiments, procures knowledge for men." Acting on this principle, he devoted his attention with equal thoroughness to the small and the great, the practical and the cultural. His chemical papers are numerous and fine. He discussed the origin of the earth, and he improved oil lamps. Yet for all his labors, fame mocked him. The years brought him only bad health and painful infirmities. Broken in body and mind, he sat down in 1826, at the age of sixty-one, to make his will, and because in that act he held true to the ideals which had inspired his life, he gained for himself an immortality which seemed to have escaped him.

James Smithson had never been in the United States. He lived in a day when Englishmen prophesied the collapse of this government; in a day, also, when great philanthropic foundations were rare. Yet he bequeathed, subject to the life interest of his nephew, his entire estate of half a million dollars "to the United States of America, to found at Washington, under the name of the Smithsonian Institution, an establishment for the increase and diffusion of knowledge among men."

Smithson died in 1829, but the estate did not revert

[1] Address of the chancellor of the Smithsonian Institution at a meeting called to consider plans for the extension of the work of the institution, held in Washington on February 11, 1927.

to the United States until the death of the nephew in 1835. From the moment in 1835 that President Andrew Jackson reported Smithson's bequest to Congress, it engaged the attention and inspired a sense of responsibility in the leading men, whether in public or private life, in this country. Such men as John Quincy Adams, then serving in the House of Representatives, and Jefferson Davis, in the Senate, appreciated the importance of the gift and its great possibilities for good if properly administered. They overcame the objections of John C. Calhoun, and others, and induced Congress to accept the bequest.

In July, 1836, Richard Rush, of Pennsylvania, who had been Attorney General, Secretary of the Treasury, minister to France and minister to England, was named to go to England to put in a formal claim for the bequest.

The English government, appreciating the nobility of Smithson's legacy, pushed a friendly suit through Chancery in the then unprecedentedly short period of two years. Consequently, in 1838, Rush was able to bring back to the United States $508,000 in gold sovereigns, a sum which later small additions brought to a total of $550,000.

Congress and the country were now faced with the difficult problem of defining knowledge and determining how best to increase and diffuse it. Five successive congresses spent much time in indecisive debate of these matters. Three presidents urged the duty of decision on them. Learned men proffered advice—voluntary and solicited. The press and the pulpit discussed the matter. But not until August 10, 1846, did the Twenty-ninth Congress give form to the long-waiting Smithsonian Institution. The long debate impressed the men of Congress and the public strongly with the country's obligation to make the institution worthy of the beneficence of the donor's gift and purpose. This alone was worth the delay.

In view of the condition of knowledge in those days many immature proposals sought to absorb the fund. The wonder is that none of them succeeded. A post-graduate university, an astronomical observatory, a normal school, a library, an institute for the promotion of agriculture, a mineralogical bureau, a system of lectureships, were suggestions advanced. The institution, as it finally took shape, was a compromise. To its charter John Quincy Adams, Joel R. Poinsett, ex-Secretary of War, Richard Rush and Robert Dale Owen contributed the basic ideas.

Among the good points of this charter were, first, the solidity of organization which it secured to the institution. It vested the Smithsonian with the prestige and dignity of the United States government by making the President, Vice-President, Chief Justice and members of the Cabinet the Smithsonian Establishment. It put the actual management in the hands of men whose positions guaranteed their high-mindedness. I refer to the Board of Regents, which includes the Vice-President, Chief Justice, three Senators, three Representatives and six citizens chosen from the country at large. It was this insured stable control which led Charles Lang Freer, of Detroit, to select the Smithsonian as the institution in this country to which he was willing to leave his rare collections of Oriental and American art and his fortune to endow them.

The second important thing the charter did was to secure the permanent investment of the principal and to permit the use of the interest only.

Thirdly, it ordered that no part of the primary fund should be expended for buildings and structures.

Fourthly, after stipulating for the inclusion of a library, a museum, a chemical laboratory, a gallery of art and lecture rooms, it left the development to a large extent in the hands of men who would be best qualified to determine what that should be.

Gentlemen, this charter was sound, but it did not make the Smithsonian Institution. The credit for that belongs to a great man, who was its first secretary. The first Board of Regents recognized clearly that the "future good name and success and usefulness of the Smithsonian" would depend in the main on the character and ability of the secretary. In selecting this officer the board sought the advice of the most distinguished men of science here and abroad. The unanimous choice of all who were consulted, including Faraday, David Brewster, Arago, Bache, Silliman, was Joseph Henry, professor of physics and natural history at Princeton. In their opinion, Joseph Henry stood "without a peer in American science." He had discovered the principle of the electric telegraph. He had anticipated the great Faraday by a year in the discovery that a magnet induces electricity, though he did not publish his results in time to get the credit. For him to undertake the organization of a new institution meant the sacrifice, to a great extent, of his own career of research and discovery. Henry knew this, and nothing less important than the Smithsonian Institution and what it could be made to mean to American science could have induced him to make this sacrifice.

He came to the Smithsonian in December, 1846, and he gave himself to the institution unreservedly for thirty-two years, until he died in May, 1878. During that time he built his own ideals into the institution. He was far beyond men of his time and many men since in his willingness to share with others, and without claim or credit, knowledge which he and his associates had gathered. His sole aim was an extension of the boundaries of knowledge.

Only last December, when the American Telephone and Telegraph Company presented a bust of Alexander Graham Bell to the institution, we heard read a letter written by Mr. Bell to his parents in 1875 when he was working on the telephone. In that letter Bell gave credit for the continuation of his researches to a successful conclusion to the encouragement and advice given him by Henry. Alexander Graham Bell was only one of many whom the first secretary of the Smithsonian inspired.

Joseph Henry gave to the Smithsonian a program of organization which has never been essentially modified. He deduced that plan from Smithson's phrase: "the increase and diffusion of knowledge among men." He proposed to increase knowledge by stimulating original research through suitable awards and pecuniary assistance, by publishing the results achieved by investigators in order to encourage them, and by promoting major investigations, like that of continental scope on meteorology. He proposed to achieve the diffusion of knowledge by publishing memoirs containing the results of original research and a series of reports, giving, in language easily understood, accounts of the new discoveries in science and of the changes made from year to year in all branches of knowledge.

Joseph Henry did not seek a great building, or a heavy administrative organization with a necessarily large overhead, nor did he feel it a justifiable expenditure of Smithson's bequest to maintain public museum collections, an art gallery and a great library, such as the charter of the institution imposed upon the funds. He saw, long before any one else, that in a short time the accumulations of a museum or a library would use up for their care alone more than the small income of the Smithsonian endowment without contributing effectively to the increase and diffusion of knowledge.

He was not against any of these things in themselves, but he did not feel that they should be supported by the Smithsonian funds. He set himself, therefore, with an ability which we can not too highly appraise, to prevent the institution from being swamped with the care of such material. While he avoided the expenditure of a large portion of the funds in this way he put the institution in the way of building a better library than could possibly be bought, by exchanging Smithsonian publications for those of learned societies throughout the world. In 1866 he succeeded in having the care of this accumulating library transferred from the Smithsonian to the Library of Congress, which agreed to give it a special custody. This has been a most happy arrangement, for it has permitted the Smithsonian to build up the foremost scientific library in this country, without bearing the cost of upkeep and care. It is called the Smithsonian Deposit in the Library of Congress.

While he was thus successful in part in saving the Smithsonian funds from the burden of caring for vast masses of museum material, it was twelve years, or 1858, before he induced Congress to recognize its responsibility for the upkeep of a national museum. It took twenty-four years before the government was persuaded to assist in any adequate way to support the great collections of the National Museum created by the Smithsonian, and for which the Smithsonian had been spending yearly more than half of its own limited income, which was in 1870 $45,000.

To illustrate how burdens that did not belong there were piled on the meager Smithsonian funds, let me cite to you the case of the International Exchanges. This service, by which the Smithsonian acted as the channel for the sending of scientific literature from this country to all institutions and learned societies abroad and receiving from abroad scientific literature for distribution among American learned societies, was inaugurated in 1847. In 1867 Congress recognized it as so efficient and desirable that it imposed upon the Smithsonian the duty of distributing and receiving governmental publications in the same way, without, however, appropriating for that purpose. From 1860 to 1876 the annual cost of the exchanges to the institution mounted from $2,348 to $10,199, but it was not until 1881 that Congress made an annual appropriation of $3,000 to this service.

The wonder is, gentlemen, that these burdens did not absorb the entire fund. That they did not is due solely to the constant struggle and self-sacrificing zeal of Secretary Henry and of his aid and successor, Spencer F. Baird. With a few thousand dollars annually, these two men performed marvels in the encouragement of investigations in every field of science and in the publication of results. They had their fingers on the pulse of American science. Where the greatest need was, there they were to help, sparingly but effectively, and it was for that reason that the institution came to be in a peculiar sense the incubator of American science.

Secretary Langley and Secretary Walcott, the successors of Henry and Baird, have held to the fruitful principles built into the institution by Henry. In their time the burden of maintaining the various government bureaus created by the institution and left for the sake of efficiency under its administration has been lifted from the small Smithsonian funds, although the immediate Smithsonian staff is not recompensed for their administrative services to these government bureaus.

I must make clear, gentlemen, that the Smithsonian Institution is not, and has never been considered, a government bureau. It is a private institution under the guardianship of the government. That point was

clearly made in the first report of the House Judiciary Committee in 1836, when it said: "The sum given to the United States by Mr. Smithson's will is no wise and never can become part of their revenue. They can not claim or take it for their own benefit. They can only take it as trustees to apply to the charitable purpose for which it was intended by the donor."

It is because the institution still administers for the government seven of the public bureaus which it created that many people suppose this private research establishment to be a part of the government. The importance of keeping the Smithsonian—in so far as it is an institution for the "increase and diffusion of knowledge"—a private organization, was early brought out by Joseph Henry. He said: "That the institution is not a national establishment, in the sense in which institutions dependent on the government for support are so, must be evident when it is recollected that the money was not absolutely given to the United States, but intrusted to it for a special object, namely, the establishment of an institution for the benefit of men, to bear the name of the donor, and, consequently, to reflect upon his memory the honor of all the good which may be accomplished by means of the bequest. The operations of the Smithsonian Institution ought, therefore, to be mingled as little as possible with those of the government, and its funds should be applied exclusively and faithfully to the increase and diffusion of knowledge among men." That this opinion is a sound one, gentlemen, we believe the Smithsonian's achievements prove. It is obvious that the freedom from political exigencies which has permitted the institution to play so great a part is due primarily to the private nature of its funds.

Gentlemen, there seems something fateful in the timeliness of James Smithson's bequest to the United States. It came to meet an unexampled opportunity. Here in 1846 was a vast untouched continent, enclosing, in a single geographical and political unit, a prolific plant and animal life ready under the most favorable conditions to reveal their secrets to botanists and zoologists; a continent peopled by a primitive race, illustrating the mode of life and habits of thought of prehistoric man, and offering a useful key to the lost story of man's climb upward. At the same time, in the hands of an energetic people were the mechanical tools—particularly steam transportation—capable of developing this new continent. Such a setting and such men to deal with it offered possibilities for the increase of knowledge such as perhaps the world had never seen before. The danger was that the men would remain blind to those possibilities and waste the setting for practical ends before those of its secrets which were perishable should be gleaned. It was a crucial moment in the history of knowledge. What was needed was some powerful inspiring force, actuated by the highest ideal of knowledge for its own sake, which would be conscious of the possibilities and which would devote its energies to making the most of them. That force the liberality of an Englishman helped to supply, and the self-sacrificing idealism of American men of science—Joseph Henry and his associates—directed. The debt of America and of science to the Smithsonian Institution is great.

Joseph Henry had the vision to understand clearly what Smithson meant his foundation to be, and the energy and character to make it that. The Smithsonian has now come to a time when without the support of the nation, it can no longer continue to be what Henry made it. And yet the need for just such an institution as it has been is no less than the need was eighty years ago. In some respects the unique opportunities are even greater. This institution is not the product of a moment; eighty years of the toil of great men have gone into its making. There is that about it which can not be replaced.

The regents have felt it their duty to reveal to a leading group of representative American citizens what it is, and does, and to advise with them what its future shall be. For that reason they have invited you here. They wish you to see the broad and comprehensive scope of the institution, competing or interfering with nobody, cooperating with all, reaching the basic problems of mankind and of the time, with a view to furnishing the information through which alone they can be solved. They wish you to see what the future possibilities of the institution are, and if you think them worthy of realization, to advise us as to how we may go about achieving it.

Around this hall are arranged exhibits of the researches and publications of the Smithsonian, with especial emphasis on how they should and could most profitably be extended. The scientists in charge are at hand to answer your questions. May we invite your careful attention to them?

William Howard Taft

Chancellor of the Smithsonian Institution

UNDERLYING FACTORS IN THE CONFUSION IN ZOOLOGICAL NOMENCLATURE WITH A DEFINITE PRACTICAL SUGGESTION FOR THE FUTURE[1]

Service of thirty-one years as member (twenty-nine of these as secretary) of the International Commis-

[1] Address of the retiring president of the American Society of Parasitologists, Philadelphia, December 29, 1926.

sion on Zoological Nomenclature has given me opportunity to study the principles of and practices in the subject rather carefully. On this basis I invite attention to certain practical aspects of the problems which should, I am persuaded, be of interest.

Raphael Blanchard once defined nomenclature as "the grammar of science"; this is the best definition of it that has come to my attention. In one of my less serious moods I once described zoological nomenclature as "that portion of zoology which puts us to sleep in the day time and keeps us awake at night; the combined nightmare, bugbear, bête noir and Katzenjammer of zoologists"; I believe you will agree with me that this is a fairly accurate generic diagnosis.

Individual zoologists have a nomenclatorial vocabulary which varies greatly in extent. Some have estimated their systematic vocabulary at about two hundred names, others at about five hundred or six hundred, still others at about one thousand to five thousand. These individual estimates are very low as compared with the estimates of the vocabulary of the entire profession, which runs into hundreds of thousands, and as fundamental in any consideration of the problems, it appears reasonable to hold in view the important principle that it is the vocabulary of the profession—not of the individual—which should govern our principles and practices. If you or I base our nomenclature solely on the names of the parasites with which we deal and overlook the importance of the names of the hosts which harbor these parasites, we soon reach a status of theoretical and practical confusion.

For instance, if, under existing conditions, one of us reports for "*Simia* species" an infection transmissible to man and of possible importance to the health and life of human beings, the rest of us do not know whether the systematic conceptions of mammalogy revert to an early status or, if they are more modern as is to be assumed, which of three genera of *Primates* we must consider in our efforts to protect human life. If one of us reports for "*Cercopithecus* species" an infection of public health importance, we do not know whether reference is made to a disease in Africa or in South America.

The first point I wish to make is that in citing our hosts it is important to cite them as definitely and as correctly as possible, otherwise our records are ambiguous both theoretically and practically; and if we govern our vocabulary purely from our subjective standpoint as applied to the parasites, instead of from the broader objective consideration as applied to the entire zoological profession, we follow a policy which is difficult of justification.

The second point I would emphasize is the tremendous economic loss, in cost of time, effort, study, paper and printer's ink, which results from the subjective rather than the objective use of a technical vocabulary. A few prominent examples may be of interest.

The economic loss to science attributable to the easily preventable confusion in the nomenclature of the protozoa (*Plasmodiidae*) involved in the malarias of man and of birds runs into the thousands of dollars, a sum of money which could have been used to much greater advantage.

The economic loss in protozoology due to easily preventable confusion in the nomenclature of the parasite (*Endamoeba histolytica*) of amoebic dysentery is probably not less than that involved in the nomenclature of the malarias.

The literature involved in the easily preventable confusion in the generic nomenclature of the common bedbug, *Cimex lectularius*, is so extensive that at a conservative estimate it required a total of sixty days' intensive study by several zoologists to work up the case for the International Commission. As one commissioner expressed it, the time spent on this case would have been sufficient to convict three murderers.

The money loss represented in time, paper and ink, involved in the controversy on Huebner's (1806) Tentamen, would supply some museum with a fairly representative collection of butterflies.

The ultimate easily preventable economic loss in mammalogy involved in the complex, interrelated cases of the names of the chimpanzee, the orang-utan and the Barbary ape would represent a very substantial contribution to the support of a college department of zoology for one or two years.

This type of preventable economic loss, in a field of science dependent upon endowment, public appropriations and private funds, is a practical question which we owe to our profession to consider seriously if we maintain that we are rational and practical human beings as well as students of science.

If the zoological profession continues to permit so much of its funds to be wasted, how can we expect practical business men and legislators to continue their confidence in the ability of the profession to administer trust funds? Had you ever thought of nomenclature from this point of view?

Clearly it behooves us to consider seriously the factors which have resulted in these and similar losses and to inhibit them in the future.

The most important factors involved are relatively few, namely, *four* involving principles and *one* involving practice, and can be easily formulated. Permit me to enumerate these five factors as I see them.

I. *Genotypes:* So far as my thirty-one years' intensive study of nomenclature can be taken as basis for conclusions, I am persuaded that a failure on the

part of authors clearly to designate, at time of original publication, the type species of their new genera, together with a failure of later authors to follow the principle of early designation of genotypes, is the greatest single formal source of easily preventable confusion in the entire field of zoological nomenclature.

An author who proposes a new generic name without definite designation of the type species can justly, though kindly, be compared with a naval architect who builds a ship but provides no rudder with which to steer it; the genus becomes a nomenclatorial derelict in the sea of zoological literature, constantly colliding with other genera, usually of similar rudderless construction.

The addition of two words to the original generic description, namely, "type *x-us*," and the observance of well-established rules of navigation would remove this very important factor in confusion. How superlatively easy this would be.

There seems to be an impression that the principle of genotypes is a conception of relatively modern nomenclature. Permit me to invite attention to the fact that Linnaeus in 1751, when he proposed the binary-binomial system of nomenclature, formulated the rules on which the system was based and that he laid the foundation of the principle of genotypes in paragraph 246.[2]

As our science advanced, Latreille in 1804–1810 definitely designated many genotypes in arthropods. Latreille's policy was followed by a number of authors (Curtis, Westwood, etc.), but numerous other authors overlooked or ignored these important contributions to this practical technique. Various sets of rules enlarged the technique, and finally the International Commission studied the subject in detail and digested and formulated (in Article 30) the methods of procedure. Contrary to the view entertained by some of our colleagues, the Boston (1907) proposition by the commission was not a new idea made retroactive, but a codification and harmonization of principles and practices already adopted by various authors.

II. *The Law of Priority:* Linnaeus in his original rules of 1751 clearly enunciated the law of priority in paragraph 242.[3] The impression that this law of priority is a relatively modern conception and that its retroactive application has caused the existing confusion is based on erroneous premises. The confusion, as respects this law, is due to the fact that so many authors adopted the Linnaean system of nomenclature (namely, biological grammar), without applying the rules on which the system was based.

The law of priority has produced so much controversy that you will doubtless permit me to present the conception of it which my experience has given to me. As I see it, theoretically and practically, we face two alternatives: First, let every zoologist adopt any technical name he wishes; or second, let us all agree to follow the Linnaean law of priority of 1751.

The first alternative is subjective and makes for confusion; the second is objective and makes for uniformity in all objective cases; but of course it does not give finality to cases of subjective conceptions of taxonomy, for these conceptions are subject to revision on basis of additional data or additional subjective interpretations.

Those of us who elect to follow the objective alternative of priority, sinking, for the general good of science, our subjective preferences, certainly have a right to conclude that any of our colleagues, who elect to follow the subjective alternative and to use any names they prefer, would find it difficult to justify themselves in criticizing those of us who prefer the second alternative; for they are hardly in a position to deny to us a right of choice in governing our policy when they reserve to themselves the right of choice in governing their procedure.

Consistent with my support of the law of priority, I recognize the fact that we should make the rules our servants rather than make ourselves the slaves of rules. Thus I approve of giving to the International Commission, as the Monaco Congress did in 1913, plenary power to suspend the law of priority as well as the other rules "when in the judgment of the Commission the application of the rules will produce greater confusion than uniformity." We have practical as well as academic problems to solve; we face conditions in addition to theories.

In general I would evaluate a failure to apply the law of priority as the second most important formal factor in nomenclatorial confusion.

III. *Homonyms:* As third formal factor in easily preventable confusion I am inclined to cite homonyms. An author publishes as new a technical name without consulting the various nomenclators (Agassiz, Marschall, Scudder, Waterhouse, Sherborn, etc.) to see whether it has already been used by some other author for some other systematic unit in such a way as to invalidate its proposition for the new systematic unit. There are literally hundreds upon hundreds of cases of this kind. Self-understood, they result in confusion. For instance, suppose a reference is made simply to "*Hamadryas*"; does it concern a lepidopteron, a mollusk, a reptile or a primate?

[2] Paragraph 246: "Si genus receptum, secundum jus naturae & artis, in plura dirimi debet, tum nomen antea commune manebit vulgatissimae & officinali plantae."

[3] Paragraph 242: "Nomen genericum antiquum antiquo generi convenit."

As an instance in point: One of my colleagues recently had occasion to consider five generic names which he wished to publish as new; as his library did not contain the standard nomenclators, he sent the names to Washington and asked whether they were available. Half an hour's examination of the nomenclators showed that three of the five names were preoccupied.

Surely every author who publishes a name as new owes it to the profession to inform himself whether the name is unavailable (because preoccupied), or available. This procedure takes perhaps five to sixty minutes, but it is well worth while, for it prevents later confusion and changes in names.

If any of you desire to endow a practical economic proposition in zoology, costing about $1,800 or $2,000 per year, you might provide that salary for the appointment of a person at some museum with extensive library facilities, to whom prospective new generic names can be confidentially submitted for consideration as to availability in order to prevent the publication of additional homonyms.

IV. *Synonyms:* Synonyms are often viewed as due to carelessness of authors, and not infrequently writers are subjected to severe criticism on this account. Permit me to analyze the subject briefly. Synonyms are either (A) objective or (B) subjective.

(A) Objective (*i.e.,* absolute) synonyms are due to three causes. Many objective synonyms are (α) the direct and inevitable result of our advance in anatomical knowledge which leads to a division of taxonymic units. Others are due to (β) deliberate, necessary and justified, or (γ) unnecessary and unjustified renaming of systematic units.

(α). As examples of objective synonyms due to advance in anatomical knowledge may be cited three changes of the name *Taenia lata* Linn., 1758, to *Bothriocephalus latus* 1819, *Dibothriocephalus latus* 1899 and the necessary change on basis of the law of priority to *Diphyllobothrium latum* 1910. (γ). The eight changes of the name of this species (or of one of its subjective synonyms) to *Taenia acephala* 1772, *T. capitata* 1772, *T. grysea* 1766, *T. hominis* 1782, *T. inermis* 1803, and *T. membranacea* 1782, and to *Halysis lata* 1803, and *Dibothrium latum* 1850, were unnecessary and unwarranted. All eight of these names are objective synonyms of earlier names.

(B) Subjective synonyms are on a totally different basis. For instance, with *Diphyllobothrium latum* are now synonymized, more or less definitely, at least:

(δ) six subjective synonyms (*balticus* 1866, *cristatus* 1873, *dorpatensis* 1886, *latissimus* 1886, *tenella* 1781, and *vulgaris* 1758) proposed for species which were considered distinct from *lata.* The name *vulgaris* 1758 has several unnecessary objective synonyms already cited under (γ). While the eight objective synonyms cited under (γ) can not be justified by any code of nomenclature published from 1753 to 1926, opinion may differ in regard to the point whether the authors were justified in publishing the six subjective synonyms cited under (δ). My viewpoint is that in case of *reasonable* doubt as to the systematic status of an animal it is always wise to publish it under a new name. This view, which will doubtless be considered unusual or even extreme by many authors, is based on the following premises:

(1) Views as to generic and specific values are exceedingly subjective. They vary from generation to generation of authors and even from year to year by one and the same author. You may recognize a genus or species as new, but I may not agree with you; time may prove that your view is correct.

(2) If time shows that an allegedly new genus or new species is identical with an earlier genus or species, no special harm is done, for a name is easily sunken in synonymy.

(3) If, however, life cycles or anatomical details of two distinct species become confused in literature, the potentialities for prolonged confusion are obvious, for it is later difficult to unscramble the confused data, which perhaps have already found their way into text-books.

(4) One of the most perplexing, most confusing and most controversial problems in nomenclature is presented by generic names based upon a misdetermined species.

Admitting that there are arguments on both sides of the question, experience persuades me that the conservative policy is to name as new species or subspecies all specimens in regard to which there is a *reasonable* doubt as to their identity with an already described species *and for which this doubt can be expressed in a differential key.* The sarcastic references often made to so-called "splitters" in taxonomy are not based upon a judicial consideration of the confusion, nomenclatorial and other, occasionally produced by authors often nicknamed "lumpers." A middle ground between the "splitters" and the "lumpers" is to recognize subgenera and subspecies in case of doubt and during transitional periods of the classification of a given group. This is clearly brought out in well-known cases like *Amoeba, Endamoeba, Culex, Anopheles, Papio,* etc.

This last deduction leads to a few words regarding subgenera and subspecies. Authors who argue that these taxonomic units are not justified theoretically, in the binominal system, are in error in their premises. As for the practical consideration, on the other hand, do we not take ourselves too seriously in our differences of view as to the limits of a genus or a

species? Even our definitions and conceptions of a genus may vary widely; hence they are subjective. A genus (as I conceive it) is a taxonomic complex of specimens grouped for the moment (according to our subjective and never absolutely perfect knowledge) around a genotype. The point that you and I may not group the same species or the same specimens around that genotype is not to be taken much more seriously, or much more capable of final objective decision between us, than is the fact why you prefer one and I prefer two lumps of sugar in a cup of coffee. If, however, we both work on the genotype basis, we inhibit confusion; and this confusion is reduced if we agree not to consider our own views as final, especially during the evolutionary and transitional stage of a new classification. This confusion is reduced still further if, instead of insisting on establishing or on rejecting full generic or specific status for a subjectively constructed group, it be conceded that both sides have grounds for the subjective conceptions, and then if we compromise by reducing the contested genus (or species) to a subgenus (or subspecies) until time proves which of us has the better grounds for his subjective views. How much more understandable the present literature on the *Culicidae* would be if this course had been followed!

Permit another illustration in point: One of the most bitter polemics ever published in zoological literature was based on the question whether certain specimens, let us call them genus *X*, species *tweedle-dee*, were conspecific with or distinct from *X. tweedle-dum*. Pages of printer's ink were issued over this point, which to the average zoologist did not amount to a proverbial "hill of beans," despite the fact that from the clinical and public health viewpoints an important problem was present. The author who claimed that *tweedle-dee* and *tweedle-dum* were specifically identical was one of my best personal friends, and he seriously assured me that he never published a statement unless he was absolutely certain of his point and that, therefore, I could safely accept his view as final. Time has proved, however, that *X. tweedle-dee* is anatomically distinct from *X. tweedle-dum*, in harmony with the clinical, biological and geographical findings. Had my good friend adopted two subspecies, namely, *X. tweedle-dum tweedle-dee* and *X. tweedle-dum tweedle-dum*, considerable time, paper, personal feeling and printer's ink would have been saved. The moral is: In case of *reasonable* doubt, recognize distinct genera and species or compromise by adopting provisionally distinct subgenera and subspecies.

The title of my paper promises you a "definite practical suggestion for the future." This promise involves the important factor of practice, as distinguished from the four factors of principles to which reference was made. The suggestion is so elementary, so easy of application, so superlatively practical that you may be surprised—possibly amused—at its enunciation. I wanted to describe it as "a common sense proposition"; but recognizing that "common sense" is subjective I will not classify it in this manner. It is based on a consideration of the question: What is the chief cause back of and underlying confusion in zoological nomenclature? Or, what is the one ultimate element which explains the chaos of words with which we have to deal? Or, what is the great explanation, *par excellence*, of the origin of the dreary, long-winded, uninteresting, somnific (rather than anesthetic), occasionally paraneurotic, nomenclatorial discussions which put us to sleep in the daytime and keep us awake at night? In technical phraseology, what is the etiology of the *average* nomenclatorial neurosis? (Note, please, I did not say psychosis.)

My answer is that it has been, from 1758 to 1926, the exception—not the rule—that pupils who study zoology have been taught the grammar of the technical language they are called upon to hear, read, write and speak.

Pardon, please, a personal experience: I studied zoology and botany in five well-known universities and zoological stations, in four countries, under nineteen well-known teachers. Then I returned home (proud of my degrees with zoology as "major") and became chief of a government division of zoology. A few weeks after taking oath of office, I was in conference with that inspiring and charming mind, Dr. C. Hart Merriam. Dr. Merriam happened to refer to the Linnaean rules of 1751, to the B. A. Rules, the Dall Rules and to the A. O. U. Code. I had no idea what he was talking about, but I refrained from differing with him in his deductions. Without exposing my ignorance, I visited the library to obtain these "things"—whatever-they-were-or-might-be. Then for the first time, after studying zoology six years, I learned to my surprise—what not one of my text-books and not one of nineteen teachers in biology had ever taught me—that the science in which I was specializing had rules of grammar, namely, rules of nomenclature, to govern the technical language I was hearing, reading, speaking and writing. If my dear friend, Dr. Merriam, ever hears of this confession, it will be the first intimation he has ever had that in the last analysis he is personally responsible for the rôle I have been playing for so many years as *Capra hircus* (synonym secretary) of the International Commission.

With my own personal experience in mind, I have

quietly inquired of my zoological colleagues whether in their college courses they had been taught the principles and practices of nomenclature. The results of this inquiry have been exceedingly interesting. A few of the younger generation have stated that as students they had had instruction in the subject or at least were told of the existence of the rules. But quite generally the reply has been that in their college and university courses both the older and the younger generations had never heard of the subject during their student days. If deductions be based on the general literature of zoology, from 1758 to 1926, the conclusion can not be escaped that a majority of the authors have been blissfully innocent of the rules of zoological grammar and that, therefore, it is not to them but to their instructors that we owe our present residual confusion in nomenclature.

The practical question arises: How much grammar should be taught to pupils?

On the hypothesis that the teacher understands his subject, I would give the following general estimates:

(1) A candidate for the degree of bachelor, with any field of biology as "minor," can be taught in one hour all the theory of nomenclature he is likely to need, namely, the existence of rules and of nomenclators, the principles of family, subfamily, generic, and specific names, and the reciprocal relations of botanical and zoological nomenclature. See Articles (of the International Rules[4]) nos. 1, 2, 3, 4, 8, 13, 14, 17, 19, 22, 26, 32.

(2) Premedical students and candidates for the degree of bachelor, with any field of biology as "major," should have one additional hour instruction in the principles of nomenclature to meet their needs; especially, the various nomenclators, the restricted circumstances under which certain names are to be changed, the rules of synonyms and homonyms and the law of priority. See Articles, 5, 6, 7, 9, 10, 11, 12, 18, 20, 21, 23, 24, 25, 27, 28, 29, 31, 34, 35 and 36.

(3) A candidate for the degree of master, with any field of biology as "major," requires still another hour instruction for his nomenclature, including the principles of genotype selection. *Cf.* Articles 15, 16 and 30.

(4) A candidate for the degree of doctor, with any field of biology as "major," requires three hours additional (total four hours) theoretical instruction for his nomenclature, including a study of "cases," as for instance, the "Opinions" issued by the commission.

This short course of instruction will give to students a theoretical background which will enable them to "play the game fairly" with the profession, to walk in the straight and narrow path, and to avoid rather than create additional confusion. But if they wish to unscramble the scrambled nomenclatorial eggs, practice and experience are just as necessary in nomenclature as in music, art, baseball, football, golf, bridge or (if you prefer) poker.

Picture, if you will, a chemist who would endeavor to write a chemical thesis without understanding those delightfully lucid and highly exciting hieroglyphics known as formulae, with which papers in chemistry are adorned (in place of the classical, learned, and awe-inspiring Latin names in zoological literature!). I hope the comparison is clear.

In *conclusion,* unless and until the principles and practices of zoological nomenclature (namely, the grammar of our science) are taught to embryonic zoologists undergoing cleavage and development of the mental elements of their professional ectodermal layer, confusion will continue; teach the fundamentals of nomenclature to students and *pari passu* the confusion will decrease. And as we reflect on the problems which confront our profession during the next one hundred years, let us recall that there are hundreds of thousands, possibly millions, of genera and species still to be given technical baptismal certificates. The practical question is, are they to be named or misnamed? If they are properly named, we apply the principles of economy (*i.e.,* good housekeeping) to our subject; if they are misnamed, we adopt confusion, extravagance and wastefulness as professional zoological principles.

C. W. STILES

U. S. PUBLIC HEALTH SERVICE

[4] International Rules of Zoological Nomenclature <Proceedings of the Biological Society of Washington, July 30, 1926, Vol. 39, pp. 75–104.

LEONCE PIERRE MANOUVRIER

ONE of the world's leading anthropologists, Léonce Pierre Manouvrier, died at his home in Paris on January 18, 1927, in the seventy-seventh year of his age. He is survived by his widow and one son.

Manouvrier was born at Guéret, Creuse, on June 28, 1850, and received his degree of M.D., with the distinction of *Lauréat,* from the Faculty of Medicine, Paris, in 1881. He began his professional career as an assistant to the noted anthropologist, Paul Broca, in the Broca Laboratory. After Broca's death, Manouvrier succeeded to the directorship of the laboratory which then became one of the laboratories of the *Ecole des Hautes Etudes.* This laboratory under Professor Manouvrier continued to be a center to which students and specialists from all over the world came. At the time of his death, Manouvrier also held two other positions, namely, director of the physiological laboratory of the Collège de France and professor

in the *Ecole d'Anthropologie de Paris*. He had been general secretary of the *Société d'Anthropologie de Paris* since 1902.

As an author, Manouvrier, who always signed himself simply as "L. Manouvrier," has left approximately 150 original memoirs and papers on anthropology and related subjects. These include memoirs on anatomy and physiology; morphological variations of the human brain, of the skull, and of the skeleton; human evolution; abnormal variations of the human body; relation of the volume and form of the brain to intelligence; proportions of the human body; anthropometry; anthropological technique; psychological concepts; will; temperament; aptitudes. His memoir on *Pithecanthropus erectus* was translated into English by the present writer while the latter was one of his students in the anthropological laboratory of the *Ecole des Hautes Etudes*.

Professor Manouvrier was the recipient of many honors: Chevalier de la Légion d'Honneur; honorary member of the Anthropological Societies of Berlin, Bologna, Coimbra, Florence, London, Moscow, Rome, St. Petersburg, Stockholm, Vienna, and Washington. Professor Manouvrier was the one foreigner chosen to represent anthropology on the lecture platform of the Louisiana Purchase Exposition, St. Louis, in 1904.

GEORGE GRANT MACCURDY

YALE UNIVERSITY,
NEW HAVEN, CONN.

SCIENTIFIC EVENTS

CONFERENCE AT THE SMITHSONIAN INSTITUTION

A UNIQUE conference in the history of American science took place on February 11 at the Smithsonian Institution. The president of the United States, the vice-president, the entire cabinet and some fifty leaders of the scientific, political and industrial life of the country, met under the chairmanship of Chief Justice William Howard Taft, to consider the future of the Smithsonian Institution, in connection with the opportunity which America now has of taking world leadership in fundamental scientific research.

The conference was called by the board of regents before the death of the secretary of the institution, Dr. Charles D. Walcott, and was held as planned in accordance with his expressed wish made a few days before his death. The purpose of the conference was to reveal the exact nature of the Smithsonian's activities in the increase and diffusion of knowledge, the strength of its position as a private institution under the guardianship of the government, its prestige as the parent of American science, and finally its possibilities as the inspirer and coordinator of basic scientific investigation in this country. The program included a carefully arranged exhibit of the researches and publications now being carried on by the Smithsonian and of their possible expansion, and speeches by Chancellor Taft and Acting Secretary Charles G. Abbot. A luncheon and round table discussion concluded the meeting.

The address of Chief Justice Taft is printed elsewhere in this issue of SCIENCE.

In dealing with the Smithsonian's activities and capacities, Dr. Abbot explained how the popular misapprehension that the institution was a government bureau had arisen from the fact that it administers seven scientific bureaus for the government. He said that the Smithsonian performed this service for the government because the bureaus in question had arisen out of Smithsonian activities. He made clear that the major work of the institution continued to be research and publication, listing fourteen distinct activities which contributed to these ends.

After the luncheon the conference discussed plans for enabling the Smithsonian to expand its activities.

This is the first time since 1878 that the Smithsonian Establishment, which includes the President, Vice-president, Chief Justice and members of the Cabinet, has met. Those invited to attend, most of whom were present, were:

The Establishment: President Coolidge, Vice-president Dawes, Chief Justice Taft, Secretary Kellogg, Secretary Mellon, Secretary of War Davis, Attorney-general Sargent, Postmaster-general New, Secretary Wilbur, Secretary Work, Secretary Jardine, Secretary Hoover and Secretary of Labor Davis. *Regents:* Senator Smoot, Senator Pepper, Senator Ferris, Representative Johnson, Representative Moore, Representative Newton, Charles F. Choate, Jr., Henry White, Robert S. Brookings, Irwin B. Laughlin, Frederic A. Delano, Dwight W. Morrow. *Officers:* Active Secretary Charles G. Abbot, Assistant Secretary Alexander Wetmore. *Conferees:* Dr. Edwin A. Alderman, Senator Hiram Bingham, Robert W. Bingham, Charles F. Brush, Dr. W. W. Campbell, Asa G. Candler, Jr., Emory W. Clark, Representative Charles Crisp, Harvey S. Firestone, Dr. Simon Flexner, Representative L. A. Frothingham, Governor Alvan T. Fuller, Elbert H. Gary, Walter S. Gifford, Chauncey J. Hamlin, Representative Cordell Hull, Robert P. Lamont, Representative Nicholas Longworth, General H. M. Lord, Dr. John C. Merriam, Senator Jesse H. Metcalf, Representative Ogden Mills, Dr. Henry Fairfield Osborn, Judge Edwin B. Parker, John Poole, John J. Raskob, Samuel Rea, Edgar Rickard, Dr. Henry M. Robinson, William B. Storey, Dr. S. W. Stratton, Silas H. Strawn, Dr. George E. Vincent, Dr. William Henry Welch, Robert Winsor, Owen D. Young.

A NEW OUTDOOR SUMMER SCHOOL OF NATURAL HISTORY FOR NEW YORK STATE

MR. CHAUNCEY J. HAMLIN, president of the Buffalo Society of Natural Sciences, and Dr. Charles C. Adams, director of the New York State Museum, have announced the establishment of a new school for the study of outdoor natural history in the Allegany State Park, about 75 miles south of Buffalo. This field school is to be located in the woods of the Allegany plateau, near the Allegany River, south of Salamanca, N. Y., where the cool summer climate is similar to that of the Adirondacks. This school-camp will be conducted during July and August.

The primary aim of the outdoor school is to supplement ordinary school work and give practical field instruction to teachers of the public schools, leaders of all kinds of young peoples' organizations interested in outdoor life such as scouts and woodcrafters—an outdoor natural history camp experience and training, of a kind that they can not obtain in cities. This work will include a first-hand knowledge of the geography, physical geography and geology of this region, which lies just beyond the margin of the glaciated region, as well as the flowers, shrubs, trees and all kinds of animals found in the region. The instruction will consist largely of field excursions under experienced leaders. Methods of collecting and preserving specimens will be given special attention. Students will be aided in their studies also by a specially prepared series of pocket guidebooks to the natural history of the region. Dr. A. K. Lobeck has prepared a guide of the physical features of the region, Dr. H. D. House and W. P. Alexander a similar guide for the study of the plants, and Dr. S. C. Bishop and W. P. Alexander a guide to the study of the reptiles and amphibians of the region. A guide to the birds by A. A. Saunders has already been prepared by the Roosevelt Wild Life Station at Syracuse. The needs of the commissioner of the Allegany State Park, who are cooperating in this project, are being recognized by giving special instruction for persons who desire to train themselves for work in parks. The training of museum workers also requires a similar experience, so that the present plan provides assistance not only for the public schools, and outdoor leadership, but as well for the museums and the parks.

The project has the approval of the Board of Regents, the officials of the Buffalo Society of Natural Sciences, and the commissioners of the Allegany State Park. The general educational supervision is furnished by Dr. Charles C. Adams, director of the State Museum.

A RESEARCH PROFESSORSHIP IN FOREST SOILS AT CORNELL UNIVERSITY

A GIFT of $130,000 for the endowment of a research professorship in forest soils in Cornell University has been announced by President Livingston Farrand, who said that the Charles Lathrop Pack Forestry Trust, founded by Mr. Charles Lathrop Pack, president of the American Tree Association, in addition to endowing the chair, had made a further provision of funds for the operating expenses of the advanced line of investigation to be undertaken.

The work will be done in the New York State College of Agriculture, and the appointment of the professor will soon be announced. The chair will be named for Mr. Pack, who is already well known for his benefactions to scientific forestry as president of the American Tree Association and as the founder of the Charles Lathrop Pack Forestry Trust. This trust is administered by his son, Arthur Newton Pack.

President Farrand made the following statement on the importance of the gift:

> In the northeastern hard-wood area, extending over the Middle Atlantic States and as far west as Indiana and Illinois, the question of proper forest care and operation depends very largely upon a study of soil conditions, and practically no data on forest soils are at present available. The proposed line of investigation is a new development in forest research in this country. It will undertake to coordinate studies in several fields of science and apply what is learned to the special soil problems involved in the business of growing healthy forests.
>
> This research will necessarily deal with the chemistry and biology of soils. It will naturally have intimate relation with the field of heredity in tree growth, particularly as it should help to solve problems of adapting certain varieties of trees to given soils. And it will similarly have a bearing on the field of plant pathology, because of the relation that soil conditions bear to diseases of trees. Many of the timber growers' problems are complex. Their solution must be looked for in several fields, including these interrelated fields of soils, genetics and forest pathology.
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> This is the first time that such a comprehensive research on forest soils has been systematically undertaken in this country. The comprehensive study of forest soils is a new line of research everywhere, and the only specialized workers in it are a few scientists in Sweden, Russia, Finland and Germany. While the work to be done under Mr. Pack's endowment will deal directly with American forest problems, its results will have international interest and general scientific value.

Mr. Pack has made other large gifts for the promotion and support of education in forestry. Recently announcement was made concerning the Charles Lathrop Pack demonstration forest, a twenty-five hundred acre tract of white-pine land on the main Adirondack highway near Lake George; and he has given

land or endowments to other American forestry schools, including the New York State College of Forestry, the Yale Forest School and the University of Washington.

AWARDS OF THE PERKIN MEDAL

On January 14, at a meeting of the American Section of the Society of Chemical Industry, the Perkin Medal was presented to John E. Teeple, consulting engineer, 50 East 41st St., New York City, for "significant scientific, technical and administrative achievements, particularly the economic development of an American potassium industry at Searles Lake, California."

The medal was presented by William H. Nichols, following introductory remarks by L. V. Redman, an account of the early days of the medalist by L. M. Dennis, and a summary of the accomplishments of Dr. Teeple by Charles H. Herty.

The Perkin Medal is awarded "annually to the American chemist who has most distinguished himself by his services to applied chemistry." It was founded in 1906 at the time of the Perkin semicentennial celebration of the coal-tar discoveries, the first medal being awarded to Sir William H. Perkin himself. *Industrial and Engineering Chemistry* prints a list of previous Perkin medalists as follows:

Date of award	Awarded to	Principal fields of inventions
1907	Sir W. H. Perkin	Discovery of first aniline color
1908	J. B. F. Herreshoff	Metallurgy; contact sulfuric acid
1909	Arno Behr	Corn products industry
1910	E. G. Acheson	Carborundum; artificial graphite
1911	Charles M. Hall	Metallic aluminum
1912	Herman Frasch	Desulfuring oil and subterranean sulfur industry
1913	James Gayley	Dry air blast
1914	John W. Hyatt	Colloids and flexible roller bearings
1915	Edward Weston	Electrical measurements; electrodeposition of metals; flaming arc
1916	L. H. Baekeland	Velox photoprint paper; Bakelite and synthetic resins; caustic soda industry
1917	Ernst Twitchell	Saponification of fats
1918	Auguste J. Rossi	Development of manufacture and use of ferrotitanium
1919	Frederick G. Cottrell	Electrical precipitation
1920	Charles F. Chandler	Noteworthy achievements in almost every line of chemical endeavor
1921	Willis R. Whitney	Development of research and application of science to industry
1922	William M. Burton	Achievement in oil industry; efficient conversion of high-boiling fractions into low-boiling fractions
1923	Milton C. Whitaker	Great constructive work in field of applied chemistry
1924	Frederick M. Becket	Process for extraction of rare metals from ores; manufacture of calcium carbide; processes for reduction of rare metals and alloys
1925	Hugh K. Moore	Electrochemical processes for caustic soda, soda and chlorine, production of wood pulp, hydrogenation of oils, etc.
1926	R. B. Moore	Work on radium, mesothorium and helium

SCIENTIFIC NOTES AND NEWS

Dr. Frank Schlesinger, director of the Yale University Observatory, to whom the Royal Astronomical Society has awarded its gold medal, sailed from New York for London on February 12 to deliver the first George Darwin lecture under the auspices of the Royal Astronomical Society. This lectureship was recently founded by Dr. J. H. Jeans, secretary of the Royal Society, and formerly professor of physics at Princeton University.

Dr. Richard Willstätter, formerly professor of chemistry in the University of Munich, who, as previously recorded, will soon visit the United States, will give a series of lectures under the Edward K. Dunham lectureship at the Harvard Medical School, beginning on March 22.

Paul G. Redington, assistant chief of the Forest Service, has been appointed chief of the Biological Survey, of the U. S. Department of Agriculture, the appointment to become effective next May, to succeed Dr. E. W. Nelson, who has asked to be relieved of his executive duties. Dr. Nelson will remain in the survey as senior biologist.

The Geological Society of London has announced the following awards: The Wollaston medal to Professor W. W. Watts; the Murchison medal to Dr. G. T. Prior, keeper of the department of mineralogy in the British Museum; the Lyell medal to Sir Albert Ernest Kitson, director of the Geological Survey of the Gold Coast; the Bigsby medal to Dr. Bernard C. Smith, of the Geological Survey; the Wollaston fund to Miss M. E. J. Chandler; the Murchison fund to Dr. S. H. Haughton, of the Geological Survey of South Africa; one half the Lyell fund to Dr. Leonard Hawkes, reader in geology at Bedford College, London, and the other half of the Lyell fund to Miss Edith Goodyear, senior assistant in the geological department of University College, London.

Dr. Hideyo Noguchi, of the Rockefeller Institute for Medical Research, has been elected an associate member of the French Society of Biology.

Gustaf W. Elmen, of the Bell Telephone Company Laboratories, has been named to receive the medal and $1,000 honorarium of the American Institute of Electrical Engineers, in recognition of his work on the development of permalloy.

Dr. Charles C. Hutchins, professor of physics at Bowdoin College, will retire at the end of the present college year and will become professor emeritus.

Dr. Lawrence W. Baker, professor of orthodontia at the Harvard Dental School, has received from the orthodontic staff of the school a silver loving cup, in recognition of his completion of twenty-seven years' service to the school.

E. H. Farrington, chairman of the department of dairy husbandry at the Wisconsin Experiment Station, has retired from active service with the title of professor emeritus after thirty-two years' service.

Dr. Wilhelm Biedermann, professor of physiology at the University of Jena, is to retire in April.

At the meeting of the American Society of Naturalists held in Philadelphia, Professor C. E. McClung, of the University of Pennsylvania, was elected president, and Dr. Donald F. Jones, Connecticut Agricultural Experiment Station, vice-president. Professor L. J. Cole, of the University of Wisconsin and the National Research Council, was elected secretary, to succeed Professor A. Franklin Shull, resigned.

Dr. Ralph Bown, radio engineer, has been elected president of the Institute of Radio Engineers, an honor given him shortly after the establishment of radiophone service between New York and London, in the development of which Dr. Bown had a prominent part. He has also been awarded the Liebmann memorial prize of five hundred dollars, which goes to the radio engineer having contributed the greatest advancement to the art during the previous year.

Lewis Buckley Stillwell, New York engineer, was reelected chairman of the Engineering Foundation, research agency of the national societies of civil, mining, mechanical and electrical engineers, at the annual meeting of the foundation held on February 17. Arthur D. Little, president of the Arthur D. Little Laboratories, of Cambridge, Mass., was elected a vice-chairman.

Dr. Alice Hamilton, of the Harvard Medical School, and Dr. C.-E. A. Winslow, of the Yale Medical School, have been appointed expert advisers to the health committee of the League of Nations.

Professor Chas. R. Fettke, of the Carnegie Institute of Technology, has been appointed honorary curator of mineralogy at the Carnegie Museum, Pittsburgh.

Dr. Henry M. Ami, formerly of the Geological Survey of Canada, Ottawa, has been elected by the graduates of McGill University to serve on the board of corporation of that university for a term of three years.

Dr. C. M. Medlar, professor of pathology in the medical school of the University of Wisconsin and assistant professor of pathology at the Wisconsin General Hospital, has resigned and will leave at the end of the present academic year to take a position with the Mt. McGregor Sanitarium in New York.

Michael Heidelberger, for a number of years connected with the Rockefeller Institute for Medical Research, has resigned to continue work as director of the chemical laboratory at Mount Sinai Hospital. The staff of the Rockefeller Institute gave a dinner in honor of Dr. Heidelberger on January 28.

L. J. Fletcher, head of the division of agricultural engineering at the University of California Experiment Station, has resigned to accept a position with a commercial firm.

Frank W. Davis has resigned from the U. S. Bureau of Mines to become metallurgical engineer for the U. S. Combustion Engineering Corporation, of New York.

Harry S. Swarth, curator of ornithology in the museum of vertebrate zoology, University of California, has been appointed curator of ornithology and mammalogy in the museum of the California Academy of Sciences, San Francisco, effective on March 1. Mr. Swarth succeeds Joseph Mailliard, who retires on account of advancing years and his desire to devote more of his time to research work.

Knud Rasmussen, the Danish explorer, is preparing for a new Arctic expedition, the aim of which will be to throw light on the emigration of the first men into the Arctic region, investigating the origin of the Eskimos and their relation to other primitive people.

Leave of absence has been granted to Professor Claire E. Turner, of the department of biology and public health at the Massachusetts Institute of Technology, to allow him to take charge of public school health education in Cleveland.

R. B. Falkenstein, instructor in biology at Lingnan University, Canton, China, has returned to America on furlough, returning *via* Siberia and Europe. His place is being filled by Mr. R. E. Wall. Both Mr. Falkenstein and Mr. Wall were formerly of the staff of the University of Minnesota. The head of the biology department at Lingnan University, Professor Wil-

liam E. Hoffmann, is also a former member of the staff of the University of Minnesota.

Professor G. Elliot Smith, professor of anatomy in the University of London, delivered the Huxley lecture at Birmingham University on February 1 on "Science and Culture."

Dr. J. S. Haldane is giving in the University of Glasgow a course of ten Gifford lectures on "The Sciences and Philosophy."

With the opening of the fall semester at Hartford Seminary Foundation, Connecticut, James Y. Simpson, professor of biology at New College, Edinburgh, will give twenty lectures on the "Relation of Religion and Science."

Professor S. C. Lind, dean of the school of chemistry at the University of Minnesota, gave the principal address at the dedication of the new chemistry building at the University of Colorado on February 19. Dr. Lind spoke on the "Progress of Chemistry in the First Quarter of the Twentieth Century."

At the regular monthly dinner of the biologists of Tucson, Arizona, on February 4, Dr. D. T. MacDougal, of the Carnegie Institution of Washington, discussed the rôle of green leaves in the synthesis of organic products necessary to man. Thirty-three biologists, including several winter visitors, were in attendance.

Professor Charles P. Berkey, of Columbia University, is lecturing at Mount Holyoke College on the evening of February 25 on certain phases of the geological work of the Third Asiatic Expedition.

On February 5, Dr. E. G. Martin, professor of physiology at Stanford University, delivered an address to the Royal Canadian Institute, on "Fatigue and Rest."

Dr. Gustave M. Hortsman, head of the department of chemistry and assistant dean of the College of Pharmacy at Fordham University, died on February 15, aged sixty-eight years.

Dr. Llewellyn Garnet Noel, professor of dental pathology in the Vanderbilt University School of Dentistry until its suspension in 1926, died on January 20, aged seventy-five years.

Joseph Jackson Lister, F.R.S., of Cambridge, England, known for his work on the Foraminifera, died on January 30, at the age of sixty-nine years.

Sir George Greenhill, mathematician, well known for his work in aeronautics and gunnery, died on February 17.

Leopold Spiegel, professor of chemistry in the University of Berlin, has died at the age of sixty-two years.

Dr. Otto Wiener, professor of physics at the University of Leipzig, has died, aged sixty-five years.

Information has been received of the death of Professor Charles Marquis Smith, associate professor of physics at Purdue University, which occurred last July at the age of fifty-four years. Professor Smith had just completed twenty-five years in the department of physics. He was a former pupil of Dr. Röntgen in the University of Munich. At the time of his death he was president of the local branch of Sigma Xi and treasurer of the Indiana Academy of Science. In 1918 he was called to Washington as one of a committee to develop a course in radio for government use.

A perpetual memorial was inaugurated in December in memory of Dr. Stanford Emerson Chaille, for many years dean and professor of surgery in the medical department of Tulane University. This memorial will be in the form of addresses, to be delivered by prominent surgeons and physicians, which will be published and deposited in an alcove to be dedicated to this purpose. The inaugural address was delivered on December 13, by Dr. Allen O. Whipple, professor of surgery at Columbia University and chief surgeon of the Presbyterian Hospital at New York City.

Nature states that a committee has recently been formed in Paris to raise funds for the erection of a monument to the memory of the famous French engineer, Gustave Alexandre Eiffel, the builder of the Eiffel Tower. Born in Dijon on December 15, 1832, Eiffel was trained as a civil engineer at the École Centrale des Arts et Métiers in Paris and became known as a great bridge builder. The contract for the tower which formed such a feature of the International Exposition of 1889 was signed in January, 1887, and the full height was reached on March 13, 1889. The steel lattice work reaches a height of 984 feet. Eiffel died on December 28, 1923, at the age of ninety-one years.

The Christian Science Monitor states that the first centenary of the passing of Alessandro Volta, who was one of the great pioneers in electrical science, will be commemorated by an exhibition to be held at the beginning of May in the Villa dell'Olmo. This villa is one of the finest on Lake Como. The exhibition will be presided over by Senator Guglielmo Marconi, and during the time the exhibition remains open an international electrical congress will sit at Como. It will be divided into three main sections, the first being devoted to a show of electric communications, illus-

trating the great progress made in the world of natural science during the last hundred years; the second will contain a national exposition of electrical industries, and the third will consist in a national exposition of the silk industry.

THE United States Civil Service Commission announces the open competitive examinations for agricultural engineer at a salary of $3,800, associate agricultural engineer at a salary of $3,000 and assistant agricultural engineer at a salary of $2,400, applications for which must be on file with the Civil Service Commission at Washington, D. C., not later than March 22. The examinations are to fill vacancies in the Bureau of Public Roads, Department of Agriculture, for duty in Washington, D. C., or in the field, and in positions requiring similar qualifications.

THE Ohio Phytopathological Society held its third annual meeting at Columbus during farmers' week. Several of the members gave plant disease talks before the various sections of the farmer's week program. Seventeen were present at the banquet held at the Neil House on the evening of February 3. Dr. H. H. Whetzel, of Cornell University, was the guest of honor and gave an address on the future of plant pathology. At the business meeting the plans for the summer meeting of the American Phytopathological Society to be held in Ohio during the coming summer were discussed. Dr. H. C. Young and Curtis May, of the Ohio Agricultural Experiment Station, succeed Dr. W. G. Stover and Sherman Humphreys, of Ohio State University, as president and secretary of the society.

THE American College of Physicians held its eleventh annual clinical session in Cleveland, Ohio, from February 21 to 25, under the presidency of Dr. Alfred Stengel, of Philadelphia.

IT has been decided to hold the next International Mathematical Congress at Bologna, in 1928.

DR. F. S. ARCHENHOLD, director of the Treptow Observatory, Berlin, has announced that the proximity of Mars to the earth has induced the arrangement of a special exhibition at the observatory. It is desired that any material relating to Mars such as old and new drawings, maps, books, etc., be sent for exhibition addressed Treptow-Sternwarte, Berlin-Treptow.

THE late Dr. Charles D. Walcott, secretary of the Smithsonian Institution, left an estate valued at more than $160,000, of which $50,000 is provided for the Smithsonian Institution, conditioned on it remaining independent of any executive branch or department of the government.

MORE than half the amount which the New York Botanical Garden is seeking as an endowment, chiefly for the purpose of building a laboratory for experimental research with plants, has been contributed, according to an announcement made by Dr. Frederic S. Lee, president of the board of managers of the garden. John D. Rockefeller, Jr., has pledged $500,000 and Edward S. Harkness has given $300,000. Additional donations which bring the total amount received so far to $1,019,000 have been made by George F. Baker, Mrs. Andrew Carnegie, Robert W. de Forest, Dr. and Mrs. N. L. Britton, Daniel Guggenheim, Mortimer L. Schiff, Mrs. Arthur H. Scribner, Felix M. Warburg, Dr. and Mrs. Lee and others.

GIFTS totaling more than $50,000 were received during the first three weeks in February by the American Society for the Control of Cancer. The amount needed to make R. Fulton Cutting's conditional gift of $250,000 available is now reduced to $260,266.

THE President in a recent letter to Congress asked for a supplementary appropriation for the legislative establishment, United States Botanic Garden, of $876,390. The sum is needed, it was stated in the letter, for the construction of the necessary buildings required for the enlarging and relocating of the botanic garden.

ACCORDING to *Popular Astronomy,* the construction of a 24-inch reflecting telescope for the University of Kansas has recently been begun. Mr. William Pitt, of Kansas City, Missouri, an amateur astronomer, will grind and figure the mirror and will build the driving clock. Mr. Pitt, who is an expert machinist, is donating his services for this purpose. Pyrex will be used in order to minimize temperature effects. It is estimated that the telescope will be ready for use in about two years. It is planned to use the instrument for determining positions of asteroids.

THE Associated Sportsmen's Clubs, of California, is leading a campaign throughout western and Pacific coast states for a fund of $10,000 to be used by the U. S. Biological Survey in defraying the expense of a preliminary survey looking toward the reflooding of Lower Klamath in California, Malheur Lake in Oregon and Bear River Marshes in Utah. Dr. E. W. Nelson, chief of the Biological Survey, has stated that, with this survey completed, the work of reflooding the areas mentioned might be accomplished at a moderate expense and dried up marshes converted from death traps into healthy resorts for birds.

ACCORDING to the *Experiment Station Record* a new wing is being added to the building of the School of Agriculture of Cambridge University, replacing a range of army huts set up in 1919. The new wing

contains a basement, three stories, and storage space in the attic, and measures 26 by 80 feet. The basement will contain three rooms, of which one is to be used for the nutrition calorimeters and another for metabolism experiments. On the first floor is a lecture room and other facilities for the work in estate management and on the second floor quarters for the farm economics staff and a library. The top floor will be devoted mainly to plant breeding, horticulture and tropical agriculture. The building is expected to be completed by April, 1927.

WISCONSIN'S first national forest will be established soon if the National Forest Reservation Commission gives its approval to U. S. Forest Service plans already approved by the State of Wisconsin. Governor Zimmerman, jointly with the Wisconsin land commission and the commissioner of conservation, has approved the proposal under the terms of an enabling act passed by the 1925 state legislature which extended permission to the federal government to acquire not more than 100,000 acres for the establishment of a national forest in Wisconsin. The purchase of the full 100,000 acres is contemplated in present federal Forest Service arrangements.

AN exhibition of some of the results of research recently carried out in adhesives (glues and sticking substances) and their application has been arranged at the Science Museum, South Kensington, by the adhesives research committee of the Department of Scientific and Industrial Research. This committee was established by the department in 1919 to continue the work of the adhesives research committee of the Conjoint Board of Scientific Societies which was set up towards the end of the war to conduct research on adhesives with the aid of a grant from the ministry of munitions. The exhibition was opened to the public on December 18, and will remain open for some months.

ACCORDING to press dispatches, the financial commission of the League of Nations assembly has decided to allot 30,000 gold francs for technical studies to be devoted especially to an investigation by a specialist of malaria and infant mortality and the creation of a system of medical statistics. The league is desirous of interesting Latin-American countries in technical activities, seeking to demonstrate that it can be useful to states who have few if any political problems to submit to Geneva.

UNIVERSITY AND EDUCATIONAL NOTES

COMPLETION of the fund of $250,000 for the erection of a biological laboratory as a memorial to the late President W. Arnold Shanklin and tentative plans for the building have been announced by Dr. James Lukens McConaughy, president of Wesleyan University.

NORTHWESTERN UNIVERSITY has received a bequest of $100,000 by the will of the late Charles Deering, machinery manufacturer, of Florida.

THE faculty of the college of applied science of Syracuse University has voted to abolish the degrees of civil engineer, electrical engineer and mechanical engineer, and will hereafter award degrees of bachelor of science in the fields of civil, electrical and mechanical engineering.

DR. WILLIAM H. EYSTER, professor of botany at the University of Maine, has been appointed to the chair in botany at Bucknell University to take effect next year.

PROFESSOR W. L. HART has been appointed chairman of the department of mathematics at the University of Minnesota to succeed Professor W. H. Bussey, who resigned the chairmanship so that he might devote more time to his duties as assistant dean and as editor-in-chief of the *American Mathematical Monthly*.

H. J. WING has resigned his position as assistant professor of chemistry at Doane College to become assistant professor of chemistry at State College, Brookings, S. D.

THE University of Pittsburgh announces that the following engineers of the Westinghouse Electric and Manufacturing Company have received part-time appointments as Westinghouse lecturers: Director of courses, C. S. Coler; electrical engineering, J. F. Calvert, A. M. Dudley, W. C. Goodwin, Q. Graham, R. E. Hellmund, C. W. Kincaid, C. M. Laffoon, C. Lynn, J. F. Peters and J. Slepian; mechanical engineering, G. W. Penney, R. Soderberg and S. Timoshenko; physics, T. Spooner; physical metallurgy, O. W. Ellis; engineering mathematics, G. B. Karelitz.

DR. ALBERT SALATHE will go to Syracuse University in February from the Centenary College of Louisiana to become associate professor in the department of chemical engineering, college of applied science.

SIRÔZI HATTAS, formerly with the Mitsubishi Research Laboratory, Tokyo, Japan, is now assistant professor of chemical engineering, Tohoku Imperial University, Sendai, Japan.

PROFESSOR WILHELM TRENDELENBURG, professor of physiology at Halle, has been made rector of the university.

DISCUSSION AND CORRESPONDENCE

BACTERIAL FILTERS AND FILTERABLE VIRUSES

Dr. S. P. Kramer's experiments with bacterial filters and filterable viruses, printed in Science for January 14, 1927, lead me to draw more general attention to some work of Professor Richard Zsigmondy (recent Nobel prize winner), to which I referred in a discussion at the A. A. A. S. meetings in Philadelphia. In Chapter XIV, on "Filtration Experiments," of his book "Colloids and the Ultramicroscope" (Wiley & Sons, 1909), he says:

> All three kinds of filters (Maassen, Pukall and Chamberland) contain pores large enough to allow the passage of gold particles of about 30 $\mu\mu$ and less. The pores of a cell are of very different sizes, the Chamberland cell containing, for example, large pores, which allow the gold particles to pass through, and others which retain most of them. The size of the pores is, however, not the sole criterion in filter experiments. It is of especial importance in coarse filters, whether the particles to be filtered are held to the surface of the cell by adhesion or "adsorption" (A), or not (B).
>
> (A) In the first instance the substance to be filtered gathers upon the outside surface (and to a certain extent in the deeper pores), and prevents the other particles from forcing their way through; first, because the pores are made smaller; second, because the particles held fast to the surface of the cell repel the freely moving particles following the course of the current.[1]
>
> (B) When adhesion or adsorption does not take place, all colloidally dissolved substances pass freely through the cell, providing the pores are large enough.
>
> In the presence of a protective colloid, *e.g.*, egg albumen, all the gold particles pass smoothly through, whereas in the absence of protectors, matters proceed as in case (A). The fact that protected gold particles of 30 $\mu\mu$ and over easily pass through Maassen and Pukall filters should be of interest to bacteriologists. The Chamberland filter, too, contains, besides the very small pores chiefly present, others which permit the passage of particles of the size mentioned.

Another point of great importance to bacteriologists has been emphasized by Professor H. Bechhold, who found that lecithin emulsions whose droplets were several μ in diameter passed through ultrafilters capable of retaining hemoglobin, and whose pores were less than 30 $\mu\mu$ (pressure 150 g./cm^2). Bechhold explains that the droplets assume a filiform shape in their passage, reforming on their exit.[2]

[1] This action may be due to the well-known negative electric charge of the particles, which apparently also affects the adhering gold particles.

[2] See Bechhold's "Colloids in Biology & Medicine," Bullowa's translation, Van Nostrand; also Vol. I of Alexander's "Colloid Chemistry, Theoretical and Applied," Chem. Cat. Co., 1926, articles on Ultrafiltration and Electro-ultrafiltration by Bechhold.

Bechhold says in the latter reference, p. 832:

> Therefore the diameter of the pores of the ultrafilter gives no definite idea of the diameter of a retained particle as far as *emulsions* are concerned, whose disperse phase has a low surface tension against the dispersing phase.

Since the work of Heilbronn, Chambers, Seifriz and others shows the great changes in viscosity which organisms exhibit during mitosis, and since changes in the milieu may produce similar changes, we must observe many precautions before hazarding an opinion about size deduced from filtration experiments. Alteration of the pH of the milieu may modify the charges of particle and of filter, and even reverse them. Salt ratios and antagonism must be considered, as well as anything leading to formation of surface films. And these or other factors may influence the viscosity of protoplasm. Professor H. Schade illustrates a phagocyte passing in filiform fashion through an orifice very much less than its average diameter, and appearing in its usual guise after it emerges on the other side of the membrane.

Jerome Alexander

New York, N. Y.

PUBLICATION BY PHOTOGRAPHY

In Science for December 31, Professor Albrecht discusses the use of photographic reproductions of typewriting in scientific publication, and mentions the difficulty of the irregular spreading of ink on the typewritten sheet. Some years ago I had occasion to publish (*American Journal of Psychology,* 29, 1918, p. 120) a 4-page psychophysical table and, wishing to obtain a clear reproduction and yet to avoid the expense of having so extensive a table set up in type, resorted to the following method which may be of interest in this connection:

The ribbon was temporarily removed from the typewriter, or set as for stencil cutting. The sheet of paper upon which the table was to be typed was covered with a sheet of carbon paper and placed in the machine. As the typing proceeded each key impinged directly upon the back of the carbon paper and made an impression from the latter on the white paper. The result was a remarkably clear reproduction, which photographed well with about 2:3 reduction and which is quite legible in the final printed form. This method is somewhat more difficult than typewriting with a ribbon, as the typist can not see what she is writing. All errors were corrected by pasting over the mistake a piece of paper with the correct figures. A new sheet of carbon paper must, of course, be used for every page. The increased

clarity of reproduction by this method, however, seems worth the extra time and effort involved.

GILBERT J. RICH

INSTITUTE FOR JUVENILE RESEARCH,
CHICAGO, ILLINOIS

IN SCIENCE for December 31, Professor Sebastian Albrecht, of Dudley University, Albany, calls attention to the callitypic reproduction of tables in Volumes IV and V of the Transactions of the Astronomical Observatory of Yale University. Some years ago during a strike of printers in the east, a number of publications depended entirely upon the typewriter and photoengraver for the preparation of their matter.

Professor Albrecht makes reference to irregularity of impressions. The electric typewriter obviates this phase, as the several models now on the market do not depend upon the touch of the fingers for impact with the paper, but have a uniform stroke, and the intensity of the impression can be regulated.

The communication refers to typing with an ordinary typewriter ribbon. During the newspaper strike in the east when copy was prepared for zinc etchings, the publishers used carbon paper made up in narrow strips the same width as the standard typewriter ribbon for the machines used, and substituted these for the ribbon. In this way a sharp impression was secured—cleaner than the impression of the type through an inked ribbon.

OTTO KNEY

THE FRENCH SOCIETY FOR BIOGEOGRAPHY

AT the time when the Société de Biogéographie enters into the fourth year of its existence, we draw the attention to this association which includes naturalists on all specialties: botanists, biologists, ethnologists, geologists and zoologists whose aim is to study in common the distribution of all beings over the surface of the globe, to specify the conditions of such distribution and to investigate into the determination of consequences of the formation of the flora and fauna both living and fossil.

The society holds every month a sitting, the order of the day of which having been settled beforehand affords useful and interesting discussions on the different subjects in hand. Besides it institutes at fixed intervals deep investigations on a subject selected among those which most deservedly engross the minds of biogeographers and whose solutions require the concourse of all the disciplines represented; thus it is that thanks to the initiative of the society, a series of memoirs bound in a volume of 250 pages has lately been devoted to the "Histoire du Peuplement de la Corse" and that it is preparing just now a new volume on "Le Peuplement des Montagnes."

The number of members of the society (the seat of which is in Paris, 61 rue de Buffon) is limited; but it is possible to procure its reports (Compte Rendu Sommaire des Séances de la Société de Biogéographie) by subscription.

LOUIS FAGE

PARIS

THE JOURNAL OF GENERAL PHYSIOLOGY

THE relation of publication to the advance of science is not open to debate, and because of the rôle which publication plays scientists are concerned in having available a suitable outlet in which to report their work, whether this be in a journal owned by a society, by an individual or endowed. Where but one journal exists in a special field of science, it becomes much more important that its editorial policies be such as to encourage the submission of the best work and that those responsible for its conduct obtain and hold the respect of workers in that field.

The Journal of General Physiology occupies a unique position, in that it offers the only outlet in America for papers in this field, and in the last analysis its policies are determined by a group virtually independent in many respects. Many engaged in research in general physiology feel that as now managed the *Journal* is not serving the science adequately. The usual courtesies of correspondence are frequently neglected, the receipt of manuscript is not promptly acknowledged, it is customary to print dates of acceptance rather than dates of receipt of manuscript, thereby depriving authors of some weeks or months of priority for new work, and in one case on record not only did the *Journal* decline to reply to any letters of inquiry concerning a manuscript but without having indicated whether or not it was acceptable, declined to return it until it was demanded by a legal representative. While this is an extreme case, the experience of several would indicate that if the *Journal of General Physiology* is to perform its functions properly, the procedures of its board should be revised, and steps taken to establish and maintain the editorial ethics which in general are accepted in the offices of scientific publications.

This matter is brought to the attention of physiologists generally as a constructive criticism and with a view ultimately to draft suggestions which it is believed those responsible for the *Journal of General Physiology* will duly consider because of their established interest in the science.

MATILDA MOLDENHAUER BROOKS

WASHINGTON, D. C.

The account given by Dr. M. M. Brooks of her unfortunate experience with a paper sent to me for the *Journal of General Physiology* is in its main fea-

tures correct. I wish to make it clear that for the mislaying of the manuscript, and for the consequent delay in ultimately returning it, responsibility rests upon me. It suffices to indicate my responsibility for it, and to offer the apology hereby made for its happening.

W. J. Crozier

In connection with the letter of Mrs. Brooks the following statement may be of interest.

The practice of printing the date of acceptance of manuscripts came about because in many cases papers had to be returned to the authors with the suggestion that certain alterations were desirable. It often happened that considerable time elapsed before they came back and were finally accepted. If in these cases the date were given when the paper was first received, it might appear that the delay in publication was entirely the fault of the *Journal* unless perhaps the true explanation were surmised in which case it is possible that it might be embarrassing to the author of the paper. The present practice avoids these difficulties and has elicited expressions of approval from many of our contributors: in fact the first criticism we have heard is contained in the letter of Mrs. Brooks. When MS has been accepted without revision, the aim has been to make the interval between the date of receipt and the date of acceptance as short as possible.

It may be added that the editors intend in all cases to acknowledge manuscripts promptly and to report as soon as possible upon their availability. It may happen that they need time to examine papers critically or it may be desirable to obtain the opinion of others. Delay is sometimes due to the absence of the editors and the necessity of forwarding MSS: this is especially the case during the summer. That delays of this sort are not serious is shown by the fact that during the last twelve months, for example, the average time elapsing between receiving a paper and sending it to press is about one month (it requires about two months to go through the press).

The editors desire to thank the contributors to the journal for their loyal cooperation in endeavoring to maintain a high standard. They will greatly appreciate suggestions by private correspondence with the object of increasing its usefulness.

The Editors of the Journal of General Physiology

THE ELDEN PUEBLO

Referring to Professor Colton's note in Science of February 4, I regret exceedingly that, through inadvertence, I neglected to state in my paper before the National Academy that Professor Colton had already mentioned the existence of "Elden Pueblo" in a manuscript now awaiting publication by the Bureau of American Ethnology. I desire to give every credit to him for his reconnoissance of the region. In saying that the ruin was "practically unknown to any scientific man," I meant simply that no thorough excavation of the ruin had ever been attempted and naturally, therefore, its exact nature, dimensions and significance could not be known.

Regarding the use of the name "Elden Pueblo," inasmuch as this is the first ruin in the immediate neighborhood of Elden Mesa to be excavated and made available to tourists and students, and as that Mesa is a most conspicuous object in the surrounding landscape, I think that the appropriateness will not be questioned. As the other ruins which Professor Colton mentions are opened up and studied, equally appropriate names can surely be applied to them.

Although Professor Colton spoke to me of the site of Elden Pueblo in connection with numerous other sites in the Flagstaff region, I must say that it was due more to the efforts of Mr. J. C. Clarke, of Flagstaff that I undertook the excavation of this particular ruin. At no time in the course of the work was Professor Colton's measured plan used. Professor Colton aided my assistants to measure off the site of the ruin and a plan was made on which the walls were drawn in as excavated.

J. Walter Fewkes

Bureau of American Ethnology,
Washington, D. C.

SCIENTIFIC BOOKS

Astronomy. By John Charles Duncan. xiii + 384 pp. 64 plates and numerous figures in the text. Harper & Brothers, N. Y., 1926. Price, $4.00.

Shortly after a copy of Duncan's "Astronomy" had been received from the publishers and while it was lying on my table awaiting examination, a student in the beginning course picked up the book and ran through the pages. His comments were, "Why don't we use this book in class? It actually seems to teach itself." A careful examination of the book has only served to convince the writer of the soundness of that student's judgment.

On the title page we find the simple statement, "A text-book"; and the book is all that and more. The liberal use of boldface type and excellent line drawings throughout the text certainly make it a manual of instruction. In addition to these features we find many splendidly executed reproductions of astronomical photographs which, together with much of the text written in a fascinating style, are sure to make the book one of interest and value to the general

reader. A certain amount of elementary mathematics is used in proving some of the statements, but in no sense can the book be called mathematical.

We find general introductions to all fields of astronomy and these are written in a fashion tending to spur the reader on to further investigation. This is admirably illustrated in the various sections dealing with controversial subjects. The author presents the factual material in an interesting style, gives the various theories equally fair treatment and then stops without thrusting his personal views to the foreground. The reader is stirred to seek further information; and it is a bit unfortunate that detailed references to the various sources are not given.

The method of treatment of the purely descriptive sections, such as those dealing with the planets, is admirable. The numerical data concerning the various objects are gathered together in tables, and these tables are placed in the body of the text and not banished to an appendix. With this material before the reader, the author is free to write his descriptions unhampered by a mass of numbers, and to point out clearly the significance of the tabular matter.

The history of astronomy has not been neglected in this text, for in nearly every chapter we find references to the pioneers in the particular field under consideration, and the dates of fundamental discoveries are indicated. The chapter dealing with the rise of the Keplerian Theory is worthy of particular mention in this respect.

The line drawings are very carefully made and chosen to explain the text in a most illuminating fashion. The star maps form a valuable feature, but it is unfortunate that, in the attempt to reduce some excellent charts to text-book dimensions, the lettering is reduced to illegibility. The photographic reproductions are splendidly done, and the subjects both new and valuable. It is very pleasing to find, in addition to the usual plate showing the circumpolar trails, plates showing the trails of equatorial stars when they are setting. Many of Professor Duncan's own plates, taken with the 100-inch, are reproduced; and the quality of these photographs is too well known to require further comment here.

It is unfortunate that such an excellently written book could not have received better treatment at the hands of those responsible for the format. The paper is much too heavy for the number of pages and style of binding, with the result that the book will not stand the treatment which it will receive in the hands of the average undergraduate. With these defects remedied, we shall have a book which will set a high standard, not only as a text for use in elementary classes in astronomy and for general reading, but also as a model for text-books in any subject.

Warren K. Green

Amherst College Observatory

SPECIAL ARTICLES

ON THE ABSOLUTE ZERO OF THE CONTROLLABLE ENTROPY AND INTERNAL ENERGY OF A SUBSTANCE OR MIXTURE

The writer read a paper on the above subject before the physics section of the meeting of the American Association for the Advancement of Science held in Philadelphia. Since the results are of a most far-reaching nature it was thought that an outline of the line of reasoning would be of interest to the readers of Science. From this outline the proof of the results could be constructed without difficulty.

The internal energy and entropy are each divided into two parts, one of which is externally controllable, and thus a function of the absolute temperature T and volume v, while the other is not. The least values these controllable quantities can have must correspond to zero values, for if they corresponded to finite quantities they would evidently not be externally controllable. If a surface is drawn corresponding to v, T, and the internal energy u as axis, using u in the general sense, the controllable internal energy is measured from the point where a plane parallel to the T and v axes touches the surface. Similarly the controllable entropy may be interpreted. The zeros of these quantities for all substances and mixtures can be shown to correspond to the condensed state at the absolute zero of temperature by means of the theorem (A) that the specific heat at constant volume is always positive, which may be said to follow from our motions of temperature and heat content, and the postulate (a) that the increase in pressure per unit increase of temperature at constant volume is not infinite, which will probably be readily admitted.

Consider first the controllable internal energy. Suppose that the substance or mixture in the condensed state at the volume v_0 and absolute zero of temperature has its volume isothermally *decreased* to v'. It can then be shown by means of the thermodynamical equation

$$\left(\frac{\partial u}{\partial v}\right)_T = T\left(\frac{\partial p}{\partial T}\right)_v - p$$

and postulate (a) that this corresponds to an increase in internal energy. U is the internal energy of the substance at the temperature T, volume v, and pressure p, and may be taken to refer to the controllable internal energy because the uncontrollable part would disappear through differentiation with respect to v. Raise the temperature to T, keeping the volume v' constant, which gives rise to an increase in the controllable internal energy according to Theorem (A), since the specific heat represents a change in the controllable energy.

Again begin with the substance at the volume v_0 and isothermal *increase* its volume to v''. No evap-

oration takes place since the molecules possess no motion of translation, and therefore there is no change in internal energy. Increase the temperature to T at constant volume v″, which gives rise to an increase in internal energy according to Theorem (A). Thus on passing from the condensed state at the absolute zero of temperature to any other physically possible state the controllable internal energy is increased, and that state therefore corresponds to the zero of this quantity.

Next consider the controllable entropy. Let an adiabatic on a v, T diagram pass through the zero of entropy. Take a point on the curve corresponding to the volume v_o and temperature T. Now if we pass from this point at constant volume v_o to the temperature $T = o$ we arrive at the point of zero internal energy. This would evidently correspond to a decrease in entropy. But the entropy can undergo an increase only, and therefore the adiabatic must pass through the point of zero internal energy. This point may therefore also be taken as the zero of the controllable entropy.

Formulae for the controllable internal energy, entropy, free energy and potential, corresponding to any possible state of matter, may now immediately be deduced. They may be used to solve thermodynamical problems, which, as will be evident on reflection, usually involve externally controllable equilibria only. In general it will appear that by the introduction of controllable quantities a new and important aspect is given to the whole subject of thermodynamics. The results given include what is known as the third law of thermodynamics, and Nernst's theorems, besides a number of other important results may be deduced directly from it, which lack of space will not allow to be given here.

R. D. KLEEMAN

SCHENECTADY, N. Y.

THE WHALE-SHARK, RHINEODON TYPUS, IN THE GULF OF CALIFORNIA

THE first and last records of this giant shark in American waters are from the Gulf of California, but these last printed records are not in scientific publications and hence are lost. Furthermore, there have come to me in letters or by word of mouth four other trustworthy accounts which corroborate the printed narratives. Hence it has seemed of value to bring all this evidence together and make definite record of it.

For the earliest account of a whale shark in the Gulf of California, one must go as far back as 1865. It seems that in the year 1858 a Captain Stone had sent to the Smithsonian Institution the vertebrae and jaws of an enormous shark captured in the waters of Lower California and known therein as the "Tiburon ballenas" or "whale shark." The data accompanying this material (length, twenty feet, width of head six feet, back covered with reddish spots, head truncated in front, etc.), together with the extraordinary tooth structures, left no doubt that it was the whale shark. These data and material came into the hands of Dr. Theodore N. Gill, and in 1865 he published a brief note entitled "On a New Generic Type of Sharks."[1]

Gill of course knew of the discovery of this fish by Dr. Andrew Smith in April, 1828, in Table Bay, Cape of Good Hope[2] and likewise he had undoubtedly seen Smith's figure published twenty years later. However, misled by Smith's description and Müller and Henle's[3] defective figure of the teeth, Gill, while retaining this fish in the family Rhineodontidae, differentiated it from Smith's *Rhineodon typus* and described it under the new name *Micristodus punctatus*—the spotted shark with the small teeth. There is, however, every reason to reduce this name to synonymy and identify this and all other specimens of whale sharks from the Gulf of California as *Rhineodon typus*. The writer has personally examined the teeth of the alleged *Micristodus* and has found them identical with those from a *Rhineodon* taken on the Florida coast. Furthermore, both sets of teeth agree absolutely with Gill's description—"Each tooth is recurved backwards and acutely pointed, swollen and with a heel-like projection in front rising from the base."

In the *Santa Catalina Islander* for May 27, 1925, the well-known novelist and deep sea angler, Zane Grey, has an article entitled "Fishing Virgin Seas." On page 10, he speaks of trying to capture off Cape San Lucas a whale shark estimated at over fifty feet in length. The story of this contest is told in Mr. Grey's characteristic vivid fashion in his latest angling book, "Tales of Fishing Virgin Seas."[4]

This giant shark was caught by a gaff hook fixed in its tail, and by this it towed the boat around, as is shown in the plates. Finally, after five hours of playing with its captors and towing them for miles, it dived into the depths of the sea, carrying off about 1,600 feet of rope before the hook tore out and set it free. Efforts were made to harpoon it, but the irons rebounded from its enormously thick hide and generally were so bent as to necessitate a visit to the blacksmith's forge.

1 Proceedings Academy of Natural Sciences of Philadelphia, 1865, Vol. 17, p. 177.

2 "Contributions to the Zoology of South Africa." *Zoological Journal*, 1829, No. 16, pp. 443–444—"Illustrations of the Zoology of South Africa," 1849, pl. xxvi, fig.

3 "Systematische Beschreibung der Plagiostomen," 1841, pl.

4 New York, 1925, pp. 204–216, pls. cxi and cxii.

Mr. Grey notes that three other specimens of *Rhineodon typus* were seen by members of his party in the immediate vicinity of the point where this attempted capture had been made. From Japanese fishermen the information was elicited that in the neighborhood of Cape San Lucas one of their net boats had been towed for eighteen hours by a big spotted shark before it finally broke the net and got away. Another boat caught a huge *Rhineodon* in its great net but managed to free the fish. Other fishermen told Mr. Grey that they saw them every season in the Gulf of California, and that they were especially numerous around Santa Margarita Island on the west coast of the peninsula of Lower California (in about Lat. 25° N.).

In May, 1926, word came to me that Mr. A. P. Murillo, of Guaymas, Sonora, Mexico, had hunted whale sharks in the waters around Guaymas (*i.e.*, in the central part of the Gulf of California). I at once wrote him and he courteously sent me both photographs and sketches of the fish. The sketches are particularly valuable inasmuch as they elucidate certain points in the structure of the shark which photographs do not bring out, since in these latter only those relatively small parts of the shark show which are above water.

Mr. Murillo unearthed a story of a huge spotted shark captured many years ago, but what is more to the point he recounted two personal experiences with *Rhineodon*. Some years ago he was with a party which harpooned a whale shark. It grounded in shallow water and later was examined at leisure. Again two years ago, while out from Guaymas in a fishing trip, his boat passed within twenty feet of a whale shark. Mr. Murillo's sketches and photographs show him to be perfectly acquainted with *Rhineodon*.

In April, 1926, the yacht *Pawnee*, of the Harry Payne Bingham Oceanographical Expedition, was in the Gulf of California. On board her was Mr. L. L. Mowbray (then of the New York Aquarium, but now in charge of the new aquarium at Bermuda) who had been urged especially to watch out for *Rhineodon*. In all he saw three live fish and one dead one. The largest of the live fish (estimated length, fifty-five to sixty feet) was seen near Cape San Lucas, the others further up in the lower gulf. The dead fish had a long cut on one side as if it had been rammed by a vessel—as indeed Mr. Mowbray conjectured. Such an occurrence has taken place at least once, as I have elsewhere recorded.[5]

In June–July, 1926, Mr. Keith Spalding, of Pasadena, California, went on an extensive fishing trip to the lower part of the Gulf of California. Learning that he had seen a *Rhineodon*, I wrote him and in answer he says that he saw it between Cerralvo Island and the peninsula of Lower California. His launch ran alongside it for several hundred yards. One of his party saw another, and he learned that they are frequently seen by sportsmen and the commercial fishermen.

In the summer of 1926, Mr. Mack Sennett, the motion picture producer, headed an expedition, equipped with a newly invented submarine camera, into the Gulf of California, and there made the most remarkable submarine moving pictures of fishes that have ever been produced. I saw the film here in New York, and at once wrote Mr. Sennett, who has been so kind as to present to the American Museum that part of the film showing the whale shark and has written me about the fish. The shark was seen in Los Frales Bay, about 40 miles within the Gulf of California on the peninsula side. Here, then, we have another and most interesting record of *Rhineodon* in these waters.

Messrs. Sennett, Spalding, Murillo, Mowbray and Grey all comment upon the fact that this shark in these waters shows no fear of boats or men. And even when attacked it makes no effort to retaliate, but stolidly pursues its unchecked and for the most part undisturbed way. This is also true of the specimens taken on the coast of Florida, as I have elsewhere recorded in this and other journals. Indeed, from extensive reviews which I have made of the accounts in the literature of whale sharks seen or captured, it is evident that this fish, the largest of the sharks, is entirely inoffensive, and in fact is so sluggish that it offers little or no resistance when being attacked. Mr. Grey's fish seemingly was the most active of any of which we have accounts, but its activity was mainly confined to swimming away, either at the surface or submerged, dragging the boats behind it. Finally it dived so deep as to take out all their line and was not seen again. This final disappearance by diving agrees with what Wright[6] relates as to the habits of *Rhineodon* in the Seychelles Islands, western Indian Ocean, when harpooned there. It is undoubtedly the fish's chief mode of defense and escape from its would-be captors.

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[5] Gudger, E. W., "An Extraordinary Capture of the Giant Shark, *Rhineodon typus.*" *Natural History*, 1923, Vol. 23, pp. 62–63, fig.

[6] Wright, E. Percival, "The Basking Shark," *Nature*, 1876, Vol. 14, p. 315.